The Impact of Physical Properties on a Subsonic Projectile's Velocity

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Since the late 1700's engineers all over the world have been working on ways to create pneumatic pod and train like systems to move passengers. One of the foremost projects related to this is The Hyperloop; a pod which travels along a several hundred kilometer low air pressure tube at speeds in excess of Mach 1. While there are a great number of engineers working to build a model which can reach these speeds, not nearly as many are considering the role passengers and cargo will play in the efficiency of the pod. The cost of Hyperloop is estimated to exceed 60 billion dollars. The costs of implementing the Hyperloop are expected to be entirely covered by revenue generated from ticket sales. If we do not understand how the pod will behave when carrying a payload, we will not be able to maximize profits and efficiency. Throughout this experiment, two projectiles with vastly different properties were used. Object one (the dart) had a mass of 1.1 grams and a rubber tip with a foam body. Object two (the marker) had a mass of 8.0 grams and was made up of hard plastic. During the experiment, a pressurized pneumatic cannon was used to accelerate both projectiles to subsonic speeds. I expected the velocity of the projectiles to decrease linearly in relation to their mass but, the data reflected a logarithmic pattern. My data showed that despite the increase in mass by a factor of 7.273, the marker moved between 1.58 and 1.75 times slower than the dart. This means despite a significantly higher mass, the marker was able to travel at a similar speed to the dart. Based on this data, the Hyperloop could potentially accommodate much more than its current projected passenger load with minimal loss in speed and significant improvement in efficiency.

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